

Letter from Alexander Graham Bell to Mabel Hubbard Bell, June 17, 1911

Beinn Bhreagh, near Baddeck, Nova Scotia. G B to Mrs B June 17, 1911. Mrs. Alexander Graham Bell, 1331 Conn. Ave., N. W., Washington, D. C. Dear Mabel:

Glad to receive another note from you dated "Tuesday" blankety-blankety-blank. Tell Elsie not to worry about anything, but just rest — and come up here as soon as she can.

Now is the time to start a fly-campaign here. Glad to notice that wire netting has been put about doors and windows and I will have a special look at the kitchen to see that it is protected and that sugar-bowls, etc. are provided with covers. Item— also a fly-proof cover for the garbage barrel outside the kitchen extension.

I have about decided to start the Recorder again. If not as a Beinn Bhreagh Recorder, as a record of items I wish to keep a permanent record of relating to experiments and thoughts. Perhaps it would be better to be a personal matter rather than a BB Recorder. Will decide after a houseboat confab.

Whatever it be, whether the BB Recorder Vol. VIII or AGB's notes Vol. I, one of the first articles will be a campaign document against flies on Beinn Bhreagh. We not only want to keep flies out of our houses and off our food; but we want to get rid of the flies themselves. WE DON'T WANT TO BREED THEM ON BEINN BHREAGH. This means a 2 vigorous attack on Davidson, Manchester and John McDermid and protection of the stable manure from flies. A washington newspaper recently reported, on the authority of the agricultural department experts, that 90% of the flies found incities were bred in stable manure; and that the protection of stable manure in certain parts of Washington, had been followed by a notable diminution in the number of house flies found in that part of the city. Beinn Bhreagh used to be wonderfully free from flies, but last year — I mean the year before

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last — we had a great many. In the light of Washington's experience I fix the blame on Davidson — and he doesn't know it yet. I shan't say anything to him until I have got my campaign document well in hand. I will include also, incidentally, an oil campaign against mosquitoes.

Another article for our new Recorder will discuss the question of the preservation of health and strength and vigor in the Tropics. This will take up the cooling question in which I have become wonderfully interested. There are certain details that I am working out in my mind relating to the use of brine as a cooling agent and I have been making numerous experiments here upon the remarkable observation made in Washington that ice floated in brine will impart to the brine a minus Temperature — below zero Centigrade.

In my note to you of June 15 I spoke of this minus temperature having been produced in salt water containing no undissolved salt; and I considered the result so paradoxical as to make me think I might have mistaken the 3 zero point of the thermometer used.

On Thursday I tested the two Centigrade thermometers I have here, both brought from France, by putting them in fresh water containing numerous small lumps of ice. After fifteen minutes I examined the thermometers and found that they both registered 0° C exactly. THE ZERO MARK WAS O. K. IN THE THERMOMETER USED IN THE EXPERIMENTS REFERRED TO IN MY LAST LETTER.

I then proceeded to repeat the experiments referred to. I placed in a bowl some salt water containing no undissolved salt. Indeed I strained the water through some thick cloth to make sure that there were no solid particles in the water used. I then put in a lot of small lumps of ice. The ice was all floating. None of the pieces touched the bottom of the bowl. In a few minutes I observed the temperature of the water and found it several degrees below zero.

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The results obtained June 14, have been amply verified by the experiments made June 15.

In both these sets of observations the temperature of the salt water was different at different levels. The water was warmest at the bottom; and the temperature gradually, and regularly fell in the higher strata of water until we came near the top. From this point the water increased in temperature up to the surface. Both at the top and bottom the water was warmer than in intermediate positions, the coldest place being at a depth of about 2 cm below the surface.

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These results indicate that salt, in a solid condition, is not necessary to the effect.

The addition of undissolved salt did not affect the general character of the result noted. The bottom temperature fell to zero; and from that point upward the temperature fell continuously until the coldest stratum was reached at a depth of 1 cm from the surface. The surface stratum was warmer.

The effect was evidently due to the action of salt (it did not matter whether in the solid or liquid condition) upon the ice. in the salt water.

Ice, of course, is simply fresh water in a solid condition; and it seemed worth while to ascertain whether the effect was due to the condition in which the fresh water was presented (whether solid or liquid); or due to the fresh water itself in whatever condition presented.

To test this point I took a vessel containing salt water; and then carefully poured on the surface some ice water, so that we had here zero-temperature fresh-water in the liquid instead of the solid condition. Before putting in the fresh water I ascertained that the temperature of the salt water in the vessel was $16^{\circ}.75$; and that the temperature was the same at all depths. The temperature of the fresh water, when introduced, was found to be

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+1°.00. The temperature of the whole mixture fell a few degrees. The lowest temperature of the whole mixture fell a few degrees, The lowest temperature noted being +10°.75. The temperature was different at different depths; and the mean of two sets of observations forms a beautifully symmetrical curve in which 5 the warmest water appears at the top and at the bottom with the coldest stratam midway between. The general character of the curve resembles that produced where ice was employed; so, although no minus temperatures were reached, or even approximated. I rather suspect that solid fresh water may not be absolutely necessary. This experiment was made in a tumbler, and it may be worth while to repeat it in a larger vessel and with a considerable quantity of ice cold fresh water carefully floating upon ice cold salt water. Inclined to think that the mixture of fresh, and salt water of the same temperature may result in a reduction of temperature. I judge this from the shape of the curve; but it has not yet been proved experimentally.

Finding some indication to support the idea that the solid or liquid condition of the fresh water presented may not be of material consequence, led me to consider whether the lowering of temperature observed might not be due to the presence of salt. Common salt (chloride of sodium) has a great affinity for water; and it may be that the lowering of temperature results from the chemical combinations of the salt with the fresh water, the lowering of temperature occuring during the process of chemical combination.

To test this point I took a vessel of fresh water and sought to discover whether the temperature would be lowered by introducing salt.

Temperature of fresh water 16°.00 at all elevations. A lot of salt was then put in the water which formed quite a thick deposit at the bottom. Immediately afterwards the temperature remained at 16°; and there was no change at different 6 elevations. I then took observations every few minutes and found the temperature gradually rising. When 17° was reached the thermometer showed temperature the same at all depths. After the lapse of an hour the temperature was constant at 18° and was practically constant at all depths although the surface temperature reached 17°.75 while the bottom showed

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18°.00. A number of observations were made indicating first, the sensitiveness of the thermometer, and second, the reality of a difference of one-quarter of a degree between the bottom and surface temperatures; and no indication between these points to suggest that the temperature had not gradually fallen from the bottom to the top.

Result :— There was no evidence of any reduction in the temperature of water by the addition of salt .

The temperature of the mixture had increased very slowly and gradually and to only a slight extent (2°C). It occurred to me that perhaps this slight increase of temperature had been caused by the heat environment, rather than by the presence of the salt. The whole body of water would, of course, naturally heat up in process of time to the temperature of the room. In order to ascertain whether this could have been the cause of the slight, but real, increase of temperature, I removed the thermometer from the water and dried it, and took the temperature of the air in the room. To my surprise the air turned out to be colder than the water. Air temperature 16°.25 Water 17°.75 at top and 18°.00 at bottom.

After the lapse of half an hour I took the temperatures again:—

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This experiment appears in my note book under date June 15 although, from the time noted, you will see that they really occurred June 16.

Time Remarks Temp. 3.50 a.m. Air 17°.00 3.52 a.m. Bottom water. 18°.00 3.53 a.m. Surface water 17°.25 3.54 a.m. Bottom water. 18°.00 3.56 a.m. Surface water 17°.25 3.57 a.m. Bottom water. 18°.00 3.58 a.m. Air 17°.00 4.00 a.m. Air 16°.00 4.02 a.m. Surface water 17°.25 4.04 a.m. Bottom water. 18°.00 4.05 a.m. BED

It rather looks as if the addition of salt to fresh water raises the temperature rather than lowers it.

This letter is sufficiently long, but I cannot close without referring to an examination I made yesterday (June 16) of the rams on Beinn Bhreagh. The moment I went up to the sheep

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barn I received quite a shock. The dead had come to life again and there was old 1502, the Dorset ram who acquired the reputation of being "a terror" once more apparently in life. A beautiful animal with much improved horns, and six nipples instead of five. He turns out to be 1929 wm 6n tw, a grandson of 1502. He is the finest ram I have ever seen and we have been fortunate indeed to have this case of reversion to the Dorset type in one of our best rams. I will say no more at present excepting that I am full of 1929, and you may therefore expect some fresh developments in my next letter.

Your loving Alec.